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VOL. 22, SEC. D. FEBRUARY, 1944 NUMBER 1

POLYCHAETA FROM THE WESTERN CANADIAN ARCTIC REGION[1]

BY E. BERKELEY[2] AND C. BERKELEY[2]

Abstract

Seventeen species of Polychaeta collected in the western Canadian Arctic are enumerated. All, except three, of these are new records from the area and one (*Sphaerodorum biserialis*) is new to science.

Introduction

A small collection of Polychaeta was made by Sergeant H. A. Larsen, master of the *R.C.M.P.* schooner *St. Roch*, during his 1936–37 cruise in the western Canadian Arctic. This collection is the subject of the present paper. It contains only one new species (*Sphaerodorum biserialis*), but the findings are nevertheless noteworthy, firstly because all of the records, excepting the three species *Harmothoe imbricata*, *Onuphis conchylega*, and *Cistenides granulata*, which were taken by the Canadian Arctic Expedition of 1913–18 (3), are new for the area, and secondly, because our knowledge of the polychaete fauna of the more or less adjacent regions to the east and west has recently been somewhat extended (1, 2) so that the affinities of the few forms recorded with those of the Hudson's Bay region on the one hand and those of the Bering Sea and Alaskan waters on the other can be more closely determined than heretofore. Moreover the collection comprises some representatives of the interesting and little known genus *Glyphonostomum* that exhibit some unrecorded characters.

Distribution

Seventeen species are represented in the collection. These are enumerated in the following table together with their previous records in Arctic or sub-Arctic waters.

The table indicates that most of the species represented in the collection are recorded from the European Arctic or sub-Arctic, whilst only about half of them are known from Alaska or Bering Sea. The records from Hudson's Bay would seem to contradict the conclusion that the affinities are with forms occurring in waters east of the area rather than west of it, but it must be remembered that, compared with northern Europe, very little collecting has been done in the Hudson's Bay region.

[1] *Manuscript received October 5, 1943.*
Contribution from the Pacific Biological Station, Nanaimo, B.C.

[2] *Voluntary Investigator.*

Present records from western Canadian Arctic	Previous records		
	Alaska or Bering Sea	Hudson's Bay	European Arctic or sub-Arctic
Harmothoe imbricata	+	+	+
Lagisca multisetosa	+	−	−
Paranaitis wahlbergi	−	−	+
Nephthys malmgreni	+	−	+
Ephesia gracilis	−	−	+
Sphaerodorum minutum	−	−	+
Sphaerodorum biserialis	−	−	−
Lumbrinereis similabris	+	−	−
Onuphis conchylega	+	−	+
Cistenides granulata	+	+	+
Samytha sexcirrata	+	−	+
Pseudosabellides lineata	+	+	−
Glyphonostomum pallescens	−	−	+
Nicolea zostericola	−	+	+
Terebellides stroemi	+	+	+
Chone duneri	−	−	+
Dasychone infarcta	−	+	+

Family POLYNOIDAE

Harmothoe imbricata (Linné) (1)

Localities. Dolphin and Union Strait, 69° 5′ N., 115° 45′ W., 60 fathoms. Bernhard Harbour, 68° 50′ N., 114° 55′ W., 5 fathoms. Cape Krusenstern Harbour, Coronation Gulf, 10 fathoms.

Lagisca multisetosa Moore (1)

Locality. Cape Bexley, Dolphin and Union Strait, 69° 5′ N., 115° 45′ W., 9 fathoms.

Family PHYLLODOCIDAE

Paranaitis wahlbergi Malmgren (9)

Anaitis wahlbergi (9), *Anaitis kosteriensis* (5)

Locality. Dease Strait, 69° N., 106° 25′ W., 45 fathoms.

Remarks. Southern (11) pointed out that the name *Anaitis* was preoccupied and suggested *Paranaitis* instead.

Family NEPHTHYDIDAE

Nephthys malmgreni Théel (5)

Localities. Dease Strait, 69° N., 106° 25′ W., 45 fathoms (several specimens). Coronation Gulf, 68° 16′ N., 114° W. (one specimen).

Family SPHAERODORIDAE

Ephesia gracilis Rathke (5)

Locality. Dease Strait, 69° N., 106° 25′ W., 45 fathoms.

Sphaerodorum minutum (Webster and Benedict) (5)

Locality. Dease Strait, 69° N., 106° 25′ W., 45 fathoms.

Remarks. Two specimens about 5 to 6 mm. long; unusually large for the species. The setae all have straight, hooked end-pieces, all of them about the same length and considerably longer than is figured by Fauvel (5).

Sphaerodorum biserialis sp. n.

Locality. Dease Strait, 69° N., 106° 25′ W., 45 fathoms.

Description. Two complete specimens, one about 4 mm. long for 23 setigers, the other about 3 mm. long for 24 setigers. The latter is considerably contracted.

The prostomium and peristomium are very similar to those of *S. minutum* as described by Fauvel (5) except that the elongated papillae that they bear are little more than threads. No eyes can be made out. There are four large capsules on the dorsum of each segment making four well defined longitudinal rows running the whole length of the body. The capsules in the outer row on each side represent the dorsal cirri, whilst the inner rows are so placed that their distance from the outer ones is approximately the same as that from the mid-dorsal line. There are no capsules on the ventral surface. The capsules tend to be more egg-shaped than those of *S. minutum*. Very small papillae (much smaller than the corresponding ones in *S. minutum*) are scattered irregularly over the dorsal and ventral surfaces (Fig. 1).

The parapodium is conical and is supported by an aciculum, which extends to the apex. The parapodium is terminated by a large papilla and several similar, but smaller, ones are irregularly placed on it. There is a well defined ventral cirrus (Fig. 2). The parapodium carries a bundle of 15 to 25 compound setae with hooked end-pieces that vary in length, those of the most dorsal in the bundle being the longest. The ends of the shafts are not denticulated (Fig. 3).

The two anal cirri are represented by capsules of the same form as those on the dorsum, but larger than those on the preanal segment.

The larger specimen is the type and is in the authors' collection.

Family EUNICIDAE

?Lumbrinereis similabris Treadwell (1)

Locality. Dease Strait, 69° N., 106° 25′ W., 45 fathoms.

Remarks. A single very small and evidently immature specimen. The general characters suggest this species, but the typical forms of the parapodia are not yet fully developed.

Onuphis conchylega Sars (5)

Locality. Dease Strait, 69° N., 106° 25′ W., 45 fathoms.

Remarks. All the specimens in the collection are in their tubes, which are very characteristic. They are flat and are coated with large pieces of shell and gravel. They are carried about freely by their inhabitants.

Family AMPHICTENIDAE

Cistenides granulata (Linné) (1)

Locality. Bernhard Harbour, 68° 50′ N., 114° 55′ W., 5 fathoms.

Family AMPHARETIDAE

Samytha sexcirrata (Sars) (1)

Locality. Dease Strait, 69° N., 106° 25′ W., 45 fathoms.

Pseudosabellides lineata Berkeley (2)

Locality. Dease Strait, 69° N., 106° 25′ W., 45 fathoms.

Glyphonostomum pallescens (Théel) (7)

Locality. Coronation Gulf, 68° 16′ N., 114′ W., 55 fathoms.

Remarks. This species is the only representative of its genus. Originally recorded from Nova Zembla, under the name *Samytha pallescens*, by Théel in 1878 (12) it was made the genotype of *Glyphonostomum* by Levinsen in 1883 (8) without examination of fresh material or any information additional to that given by Théel. In 1909 Fauvel (4) recorded two small specimens from the neighbourhood of Newfoundland and placed the species in the genus *Sabellides*. He expressed the view that Levinsen's genus *Glyphonostomum* was unnecessary. In 1917 Hessle (7) redescribed the species from fresh material collected in the vicinity of the type locality, showed that it could not be included in *Sabellides*, and restored Levinsen's generic name. We know of no reference to the genus in more recent literature. The prostomium, in shape and structure, is unique amongst the Ampharetidae and it was by reason of

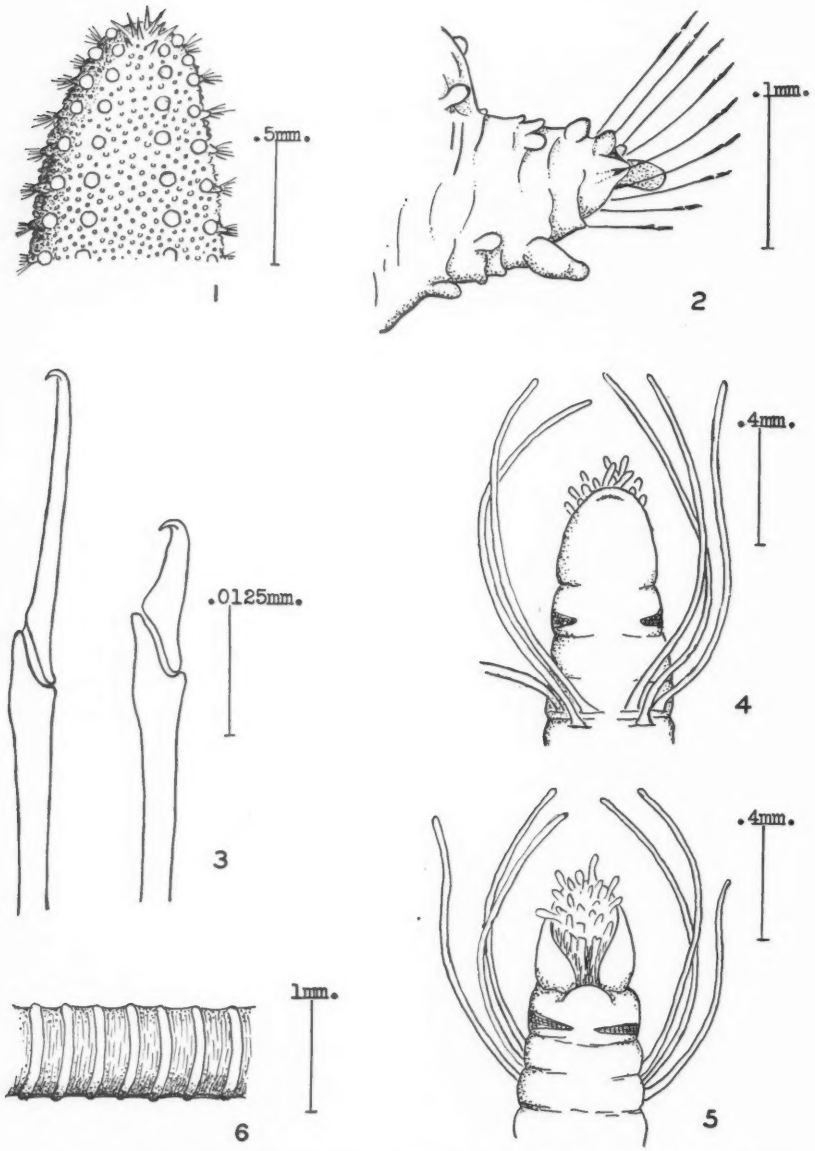

FIG. 1. *Sphaerodorum biserialis sp. n. Anterior end, dorsal view.* FIG. 2. *Sphaerodorum biserialis sp. n. Parapodium.* FIG. 3. *Sphaerodorum biserialis sp. n. Dorsal and ventral setae.* FIG. 4. *Glyphonostomum pallescens (Théel). Anterior end, dorsal view.* FIG. 5. *Glyphonostomum pallescens (Théel). Anterior end, ventral view.* FIG. 6. *Glyphonostomum pallescens (Théel). Portion of tube.*

these characters that Levinsen considered it necessary to set up a new genus. No tentacles were shown in Théel's original specimen, but Hessle (7) described them as smooth.

The two specimens in the present collection are both complete. One is 22 mm. long and 0.5 mm. wide, the other about 13 mm. long and 0.3 mm. wide. Thus the species is unusually slender for one of the Ampharetidae. The prostomium agrees sufficiently closely with Théel's description and figures, having regard to the fact that in our specimens the tentacles are extended whilst in Théel's they were evidently retracted. This gives the prostomium the somewhat different appearance shown in the figures (Figs. 4 and 5). The tentacles are smooth and short. The six filiform branchiae are arranged exactly as Théel describes, but in our specimens their length is more nearly four times than three times the body width. The most anterior setae are immediately posterior to the first pair of branchiae (i.e. on the third somite). There are no paleae and 14 thoracic setigers. Uncini begin on the fourth setiger. There are about 20 abdominal segments without dorsal cirri. The anus is surrounded by a ring of small papillae. We have not observed the two long anal cirri mentioned by Théel and Hessle. The tube, which has not been described previously, is very beautifully constructed of fine sand on a membranous base. It fits the animal tightly and is minutely and regularly annulated (Fig. 6).

Family TEREBELLIDAE

Nicolea zostericola (Oersted) (6)

Localities. Cape Krusenstern Harbour, Coronation Gulf, 10 fathoms. Bernhard Harbour, 68° 50′ N., 114° 55′ W., 5 fathoms.

Terebellides stroemi Sars (1)

Localities. Dolphin and Union Strait, 69° 5′ N., 115° 45′ W., 60 fathoms. Coronation Gulf, 68° 16′ N., 114° W., 55 fathoms.

Family SABELLIDAE

Chone duneri Malmgren (6)

Localities. Dease Strait, 69° N., 106° 25′ W.; 45 fathoms. Coronation Gulf, 68° 16′ N., 114° W., 55 fathoms.

Remarks. The three specimens are unusually small for the species, but are, apparently, mature and morphologically typical.

Dasychone infarcta (Kröyer) (10)

Locality. Dease Strait, 69° N., 106° 25′ W., 45 fathoms.

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THE MORPHOLOGY, TAXONOMY, AND LIFE HISTORY OF *METORCHIS CONJUNCTUS* (COBBOLD, 1860)[1]

By Thomas W. M. Cameron[2]

Abstract

A trematode, widely distributed in Canada, and occurring in man and other fish-eating mammals, is described and its taxonomy discussed. Its life cycle has been worked out and it is shown to involve a snail, *Amnicola limosa porata* as first intermediate host and a fish, the common sucker (*Catostomus commersonii*) as the second intermediate host. The larval stages are described.

The trematode that forms the subject of this study was originally described by Cobbold (5) in England in 1859.

> "*Distoma conjunctum* (Cobbold).—*Corpus* planum, oblongum, antrorsum sensim angustatum utrinque obtusum. *Collum* continuum. Acetabulum, ore paulo majus, ad colli basin. *Aperturae* genitales supra et pone acet. Longit. $\frac{1}{4}$ unc.; crass. $\frac{1}{12}$ unc.
>
> "*D. conjunctum* (nov. spec.), Cobbold (MS.). *Hab.* I found numerous examples of this fluke in the biliary ducts of an American Red Fox (*Canis fulvus*) which died in the Zoological Society's Gardens, Regent's Park. Two of the worms were in copulation."

This description was repeated in 1860 (6), with the addition of a drawing of the parasite. The original specimens are now in the collection of the Department of Helminthology, London School of Hygiene and Tropical Medicine and in 1938, through the kindness of Professor R. T. Leiper, I was able to examine these. There are several fragments on a single slide, and while these were obviously in a poor condition when mounted, there is no doubt that the material forming the basis of this study and that found by Cobbold in a red fox in the London Zoological Gardens belong to the same species.

Distoma conjunctum of Lewis and Cunningham, 1872, (12) and of McConnell, 1876, (14) are not conspecific with Cobbold's species—a doubt expressed by Stiles and Hassall in 1894 (19). These were later renamed *caninus* by Barker (2) and *indicus* by Stephens (18); both are synonyms of *Opisthorchis noverca* Braun, 1903 (3).

In 1899, Looss (13) established the genus *Metorchis*, with *Metorchis albidus* (Braun), as type. He described his genus as follows:—

> "Body medium or small, short compared to width and tapering slightly anteriorly. Spines generally present. Digestive organs as in *Opisthorchis*, caeca generally extending to posterior end. Ovary, *receptaculum seminalis* and Laurer's canal as in *Opisthorchis*. Coils of uterus more compact than in *Opisthorchis* and often extending laterally over intestinal caeca and anteriorly beyond the ventral sucker. Yolk glands compact extending anteriorly beyond acetabulum." Cobbold's species was included in this genus by Looss.

Meanwhile in 1894, Stiles and Hassall (19) described a trematode from the cat in the United States, under the name of *Distoma* (*Dicrocoelium*) *complexum*.

[1] *Manuscript received November 24, 1943.*

Contribution from the Institute of Parasitology, McGill University, Macdonald College, Que., with financial assistance from the National Research Council of Canada, awarded through the National Committee on Fish Culture.

[2] *Professor of Parasitology, McGill University, and Director, Institute of Parasitology, Macdonald College, Que., Canada.*

This is distinguished from the present species by the fact that the yolk glands cross the intestinal caeca to meet anterior of the acetabulum. It was afterwards placed in the genus *Opisthorchis*. However, in 1913, Skrjabin (17) made it the type of a new genus, *Parametorchis*, of which the main character was this union of the yolk glands anterior to the "rosette"-shaped uterus; the genus *Metorchis*, which also had a "rosette"-shaped uterus, had the yolk glands in two separate lateral groups. The word "rosette" should not be taken literally; it refers to a tubular uterus, with coils heaped up on themselves and more or less surrounding the acetabulum, contrasted with the undulating form seen in *Opisthorchis*.

In 1926, Hung (11) described a fluke from the cat; this he called *Parametorchis noveboracensis*. In 1929, Price (16) described *P. intermedius* and *P. canadensis* from the silver fox and the mink respectively, from material collected by Law and Kennedy in Canada, and in 1934, Allen and Wardle (1) described *P. manitobensis* from the dog. All of these are separable from each other on the basis of the specimens examined at the time of the various descriptions. However, when a large series is available and different hosts are infected experimentally from the same source, the differences disappear and all appear to be synonyms of Cobbold's *Distoma conjunctum*.

All, however, had been placed in the genus *Parametorchis*. I have been unable to find any character that justifies the placing of Cobbold's species in any genus other than *Metorchis*. This leaves the genus *Parametorchis* with a single species, *P. complexus*, characterized by the union of the vitellaria.

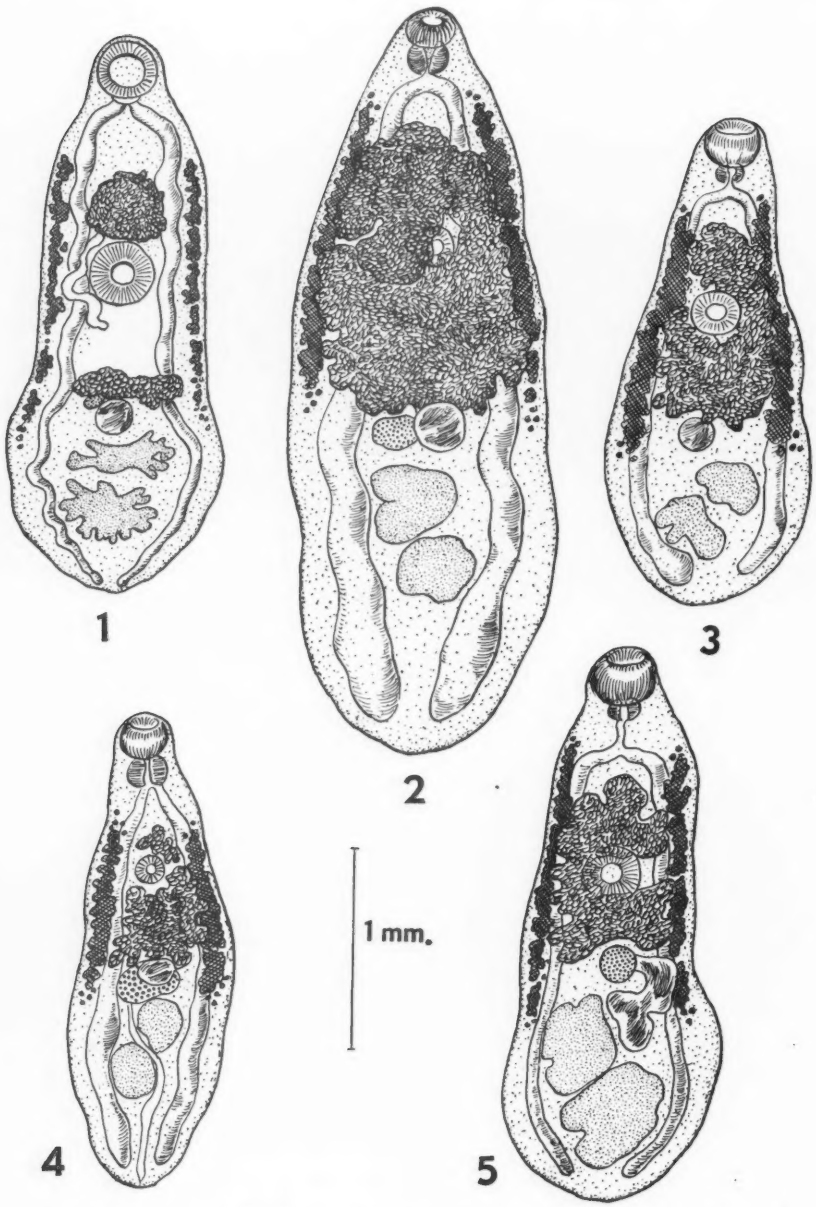
Meanwhile, in 1934, Hsu (10) described from China, *Metorchis felis*, closely related to, but distinct from, *M. albidus*. Accordingly, the genus *Metorchis* has now three species in mammals, *M. albidus* from Europe, *M. felis* from China, and *M. conjunctus* from North America.

Morphology

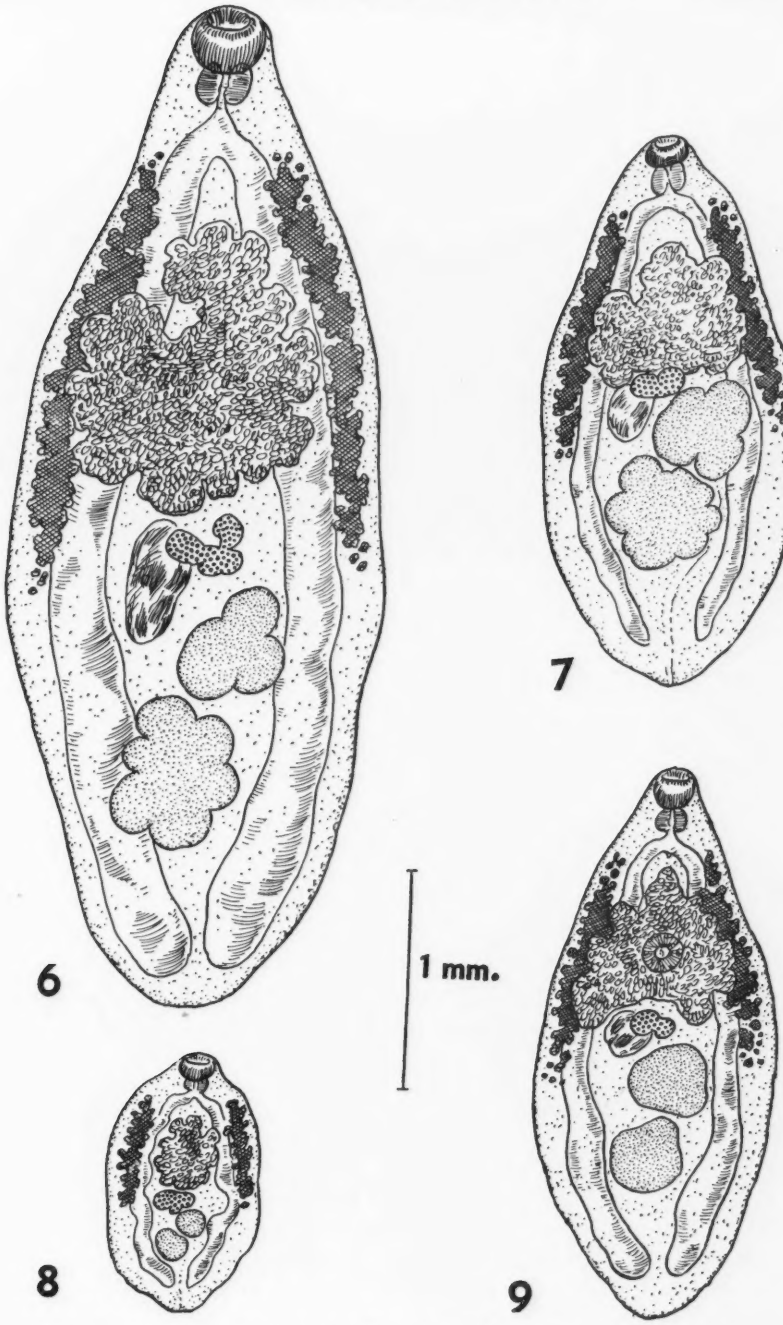
(Figs. 2, 4, 6, 7, 8 and 9)

There is a great variation in size in this species, the dimensions being larger in specimens from dogs and racoons than from foxes and in specimens from foxes than from cats, while from mink, they are very small; in fact, the size of the parasite is roughly proportionate to the size of the host. The maximum length is 6.6 mm., the minimum for mature specimens is 1.0 mm. The maximum width is 2.6 mm., the minimum is 0.59 mm. The oral sucker is 0.090 mm. to 0.240 mm. in diameter but varies considerably according to its state of contraction. The diameter of the acetabulum is about the same as that of the oral sucker; both are about equal to the length of the pharynx.

The body is usually linguiform with a tendency for the width at the level of the testes to be greater than elsewhere. In a few specimens, the shape approximated to pyriform but this was never as obvious as in the drawings of *M. albidus*. (It should be noted, however, that not all specimens of *M. albidus* are pyriform and some in my possession, sent me by Professor



FIGS. 1 TO 5. *Species of Metorchis in mammals. 1. M. felis from dog; China. 2. M. conjunctus from dog; Canada. 3. M. albidus from dog; Roumania. 4. M. conjunctus from fox; Canada. 5. M. albidus from fox; Roumania. All drawings are to the same scale.*



FIGS. 6 TO 9. *Metorchis conjunctus from various hosts in Canada. 6. From racoon. 7. From ferret. 8. From mink. 9. From cat. All drawings are to the same scale.*

Ciurea, are linguiform in shape.) The acetabulum is inconspicuous and lies about the junction of the anterior and second third of the body length. The genital pore is just anterior to this and is median in position. The body cuticle is provided with small spines. The excretory pore is terminal and the bladder is tubular, running a sinuous course between the two testes and bifurcating at the anterior margin of the anterior testis.

The intestinal caeca are voluminous and reach almost to the posterior end of the body; they are more or less sinuous depending on the state of contraction of the worm. There is no prepharynx.

The male genital system consists of two roughly spherical testes, which may be lobate or entire; there may be as many as eight lobes or as few as one but the testes are never dendritic. The posterior testis is usually more lobed than the anterior. They are situated in the third quarter of the body, either tandem to each other or, more frequently, slightly oblique. The anterior testis is often, but not always, slightly smaller than the posterior; size varies from 0.120 to 0.500 mm., the larger testes being found in the larger parasites. The seminal vesicle is an enlargement of the vas deferens and is slender and sinuous. There is no cirrus.

The female system shows considerable variation. The ovary varies from spherical or oval to trilobed and is from 0.100 to 0.260 mm. in diameter; it is situated a short distance in front of the anterior testis. Immediately behind, or slightly overlaid by, the ovary is the receptaculum seminis. It is considerably larger than the ovary but varies in shape from trilobed to entire. The yolk glands are lateral to the intestinal caeca and do not cross the middle line of the body. They extend from the level of the ovary (i.e. the middle of the body) forward to the junction of the anterior and second sixth of the body length.

The uterus is voluminous and occupies most of the space anterior to the ovary, between the two caeca, which it usually slightly overlaps. It extends just anterior to the acetabulum, which it often obscures when cleared specimens are viewed under the microscope. The uterine coils are closely heaped together to form a piled-up mass in which individual loops usually cannot be seen.

It does not form a 'rosette' in the literal sense of the word as the arrangement is much too irregular. However, 'rosettiform' can be used conveniently to contrast its appearance with that of the obvious, tubular, sinuous uterus of *Opisthorchis*.

The eggs vary in size from 22 to 32 μ long by 11 to 18 μ wide. They are yellowish brown in colour. The operculum is distinct. The outline is usually oval but may be slightly constricted anteriorly. They are embryonated when laid.

Taxonomy

There are at present three recognized species of *Metorchis* from mammals: *M. albidus*, *M. felis*, and *M. conjunctus*. All have very similar characteristics and all have definite geographical distributions.

M. albidus, the European species, and *M. felis*, the Chinese species, have been compared and differentiated by Hsü, Du, and Chow (9), on the basis of both published descriptions and actual specimens from both localities. They point out the comparatively smaller size of the European specimens, their more spatulate shape, the extension of the yolk glands anterior of the uterus, contrasted with the Chinese forms in which the yolk glands and uterine coil have the same anterior limits. The European specimens have less distinctly lobulated testes than the Asiatic ones.

In the present very extensive series of specimens from Canada, some of these points appear important. Size by itself is valueless. In the Canadian forms, the spatulate shape of the European forms is wanting, although it is true that some specimens do show a posterior widening. In the Canadian forms, the yolk glands extend beyond the margin of the uterine coils, and the lobulations of the testes, when present, are comparatively shallow.

M. albidus: Europe. Body spatulate, testes slightly lobed, yolk glands extend anterior of uterine coils. (Figs. 3 and 5).

M. felis: China. Body linguiform, testes deeply lobed. Yolk glands do not extend anterior of uterine coils. (Fig. 1).

M. conjunctus: North America. Body linguiform, testes entire or slightly lobed; yolk glands extend anterior of uterine coils. (Figs. 2, 4, 6, 7, 8, and 9).

M. albidus reported in 1937 by Freeman and Ackert (7) from a dog in California, recently imported from Alaska, quite possibly should be referred to *M. conjunctus*. However, Alaska is out of the present known range of this species and the species described by Freeman and Ackert shows a spatulate body and its exact identity must remain in abeyance for the present.

The life history of *M. felis* is unknown; so also is that of *M. albidus*, other than that it is carried by fish. When details of these life cycles become available, the systematic position of the three mammalian species may require revision.

Distribution

The distribution of *Metorchis conjunctus* in Canada has already been described by Cameron, Parnell, and Lyster (4). It covers roughly an area of 750,000 square miles from the Laurentian Mountains to the height of land in Saskatchewan and from the border as far north as Moosonee on Hudson's Bay. It has been found naturally in man, dog, red fox, mink, racoon, and cat and experimentally in dog, cat, red and silver foxes, mink, and ferret. It has not been found naturally or experimentally in any species of birds and so far experimental infection of laboratory rodents has been unsuccessful; so also was an attempt to infect a pig.

The first discovery in man was made by Miss Ruby Bere in Saskatchewan as the result of discovering the characteristic eggs in the stool of an Indian patient.

Life History

The Lake Edward area (Quebec County, Que.), as the result of the survey of internal parasites still in progress at this Institute, was known to be a centre of infection as both mink and red fox collected from there were heavily infected with *Metorchis conjunctus*. Since 1936, at one time or another, various members of the Institute staff visited the lake and collected hundreds of fish. Only seven species were found:

Semotilus atromaculatus (and perhaps other minnows)
Speckled trout
Lake trout
Yellow perch
Whitefish
Red-horse sucker
Common sucker

All of these were examined carefully and all species were fed to individual cats raised from birth at the Institute of Parasitology and maintained on a fish-free diet. Only the common sucker (*Catostomus commersonii*) proved infected. Sometimes the infection was so heavy that two to three fish about six inches long contained sufficient metacercaria to kill a kitten. During the seven years this work has been in progress, no other fish have been implicated, although fish have been collected each year. The common sucker appears to be the only fish host.

Digestion experiments carried out by Drs. Ferguson and Miller revealed the presence of *two* metacercariae in the flesh of this fish; one of these was *Metorchis*, the other *Amphimerus elongatus* Gower (8) of ducks; the latter developed also in day-old chicks.

A survey of the snails from Lake Edward showed the presence of *Amnicola limosa porata* and *Campellana* sp. as well as various non-operculated varieties. Thousands of these snails have been examined in the laboratory and while several species of cercariae were seen, lophocercous forms were found only in *Amnicola**. Unfortunately, at least two species were encountered, corresponding to the two species of metacercariae in the suckers**.

Considerable difficulty was encountered in maintaining both amnicolas and suckers alive in the laboratory and it was not until last year that this was accomplished successfully. As it is, the complete life cycle has not been carried out in the laboratory. However, suckers have been fed to cats, which have become infected; the fluke eggs have been fed to *Amnicola* and the cercaria developed. Simultaneously "wild" cercariae have been used to infect suckers obtained from a liver-fluke–free area and infection in a cat established.

* *These same snails carried various other cercariae, e.g. Xiphiocercaria (10%), a very active amphistome (0.5%).*

** *The large species proved to be that of M. conjunctus. The small cercaria is dark and active; under a cover slip, it retains its tail, keeps its ovate shape, and has a prominent excretory bladder. However, what may be a different species also occurs. It is about the same size, lighter in colour, but loses its tail under the cover slip and becomes elongated; its excretory bladder is not so constant.*

These two sets of experiments are interlocking, and they establish beyond doubt, not only the life cycle but the identity of the various stages described in this paper.

According to a personal communication from Mr. A. LaRocque, of the National Museum at Ottawa, the distribution of this trematode in Canada corresponds with the distribution of *Amnicola limosa porata*. Varieties of this species occur in Quebec and Ontario from Moose Factory southward, the Abitibi region, and the entire St. Lawrence drainage. They occur in various lakes in Manitoba and Saskatchewan, but not in the Mackenzie River drainage where they are replaced by *A. emarginata*. This latter snail is also widespread in the *limosa* areas mentioned above. This genus is the nearest American relation to *Bithynia*, the genus of old world snails in which *Opisthorchis* spp. develop.

The life cycle of *Metorchis conjunctus* is very similar to that of *Opisthorchis felineus* Rivolti, 1885, as described by Vogel (20). The egg, when laid by the fluke, is already embryonated. The miracidium has a comparatively small number of long cilia, a small "primitive gut" cell at the pointed anterior end and a large central granular cell.

The egg is ingested by the snail and the miracidium presumably escapes in the intestine, as it does in the cases of related species. In the liver of the snail, it becomes a sporocyst (Fig. 10) which, as in *Opisthorchis felineus*, gives rise to a brood of rediae.

The redia is a simple colourless structure without a collar (Fig. 11) but with a fairly prominent oral sucker. It in turn gives rise to a brood of cercariae.

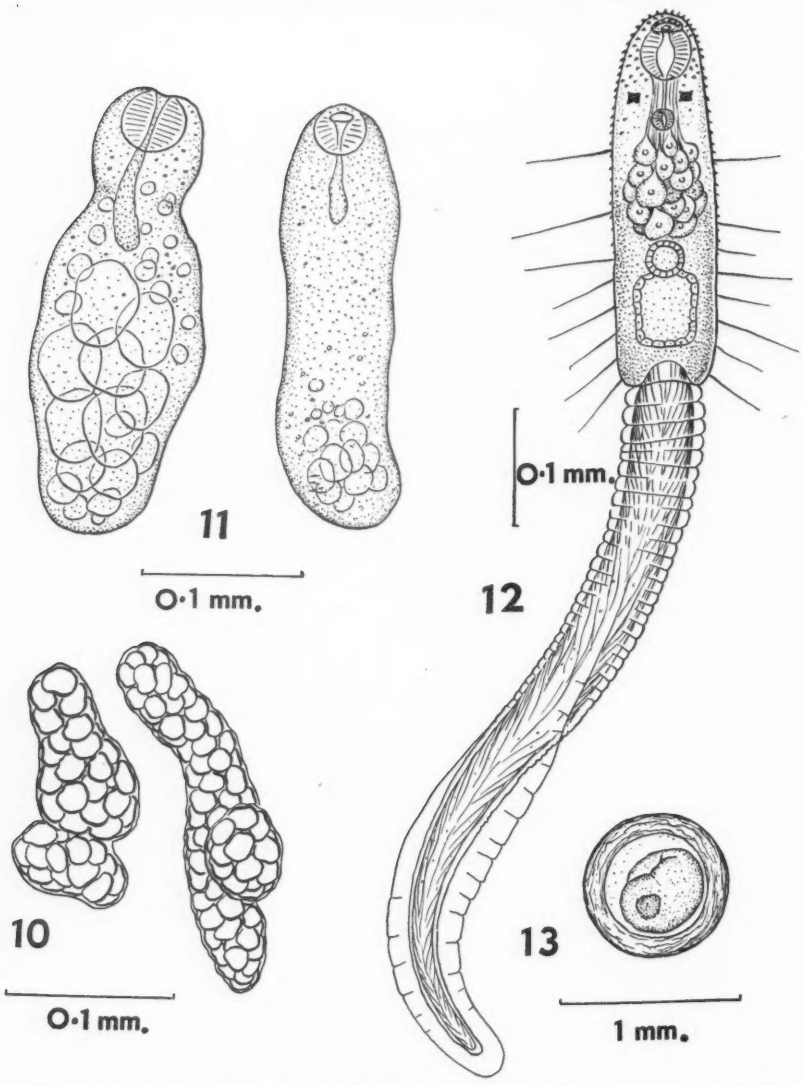
The cercaria (Fig. 12) is a typical pleurolophocercous cercaria. It has a total length of 0.925 mm.; of this 0.3 mm. is occupied by body and 0.625 mm. by tail. The maximum width is 0.075 mm.

The body is covered with minute spines arranged in transverse lines; these spines are most numerous in the anterior half of the body. In the posterior half, there are eight pairs of protoplasmic hairlike processes. There is an obvious, but feebly muscular acetabulum at about the junction of the mid and posterior third of the body.

The oral sucker is a prominent, oval, protrusible organ with numerous large spines on its anterodorsal edge, on which the eight pairs of ducts of the penetration glands open in four groups of 3, 5, 5, and 3. These glands lie in the middle third of the body and the ducts pass dorsal to the oral sucker to their opening. They arise in two bundles of eight each, but divide at the posterior margin of the sucker.

Just posterior to the sucker is a pair of dark brown, roughly square, eye spots. Posterior to them is the prominent pharynx. This is joined to the oral sucker by an oesophagus, but the alimentary tract is otherwise incomplete.

The penetration glands lie posterior to this pharynx and the large bladder with its lining of cubical cells just posterior to them. The bladder is more or less rectangular in outline.



FIGS. 10 TO 13. *Larval stages of Metorchis conjunctus. 10. Sporocysts. 11. Young rediae. 12. Cercaria. 13. Metacercaria in cyst from sucker.*

The genital primordium could not be seen. This may be due to the presence of numerous light brown pigment cells and cystogenous cells that are scattered throughout the body.

The long and powerful tail has the cuticle elevated and annulated at its proximal end; this is especially prominent laterally and ventrally. The fin-

fold is dorsoventral in position. On the dorsal side it is carried much farther proximally than on the ventral and is wider. It is continuous round the tip of the tail.

The cercaria, which has a potential life of between 60 and 72 hr., spends most of its time lying on the bottom of containers. It is more or less positively heliotropic.

The metacercaria is enclosed in a transparent, colourless, almost spherical cyst, about 0.4 mm. in diameter (Fig. 13). The metacercaria very closely resembles that of *Opisthorchis felineus* (20). Its excretory system was not studied.

By careful artificial digestion of portions of infected suckers from Lake Edward, Dr. M. S. Ferguson was able to show that the metacercariae were confined to the musculature of the body, especially to the main lateral muscles from the level of the dorsal fin to the tail. This is in sharp distinction with the small *Amphimerus* cysts found in the same fish host, which are practically confined to the fins and the adjacent tissue, with a small number in the head.

Cysts isolated by digestion have been fed to cats on several occasions but no infection resulted, although portions of the same fish that had not been subjected to the digestive process gave successful results. The cysts are destroyed on heating to 70° C. Their viability is probably reduced by lower temperatures but, as this had already been affected by the digestive process, it could not be measured.

The cyst has an inner membraneous wall, which is not affected by pepsin or by trypsin, and an outer cyst, which is not affected by pepsin but is digested by trypsin. The young fluke apparently escapes mechanically from the inner cyst.

The young *Metorchis* apparently reaches the liver by migrating up the bile duct, in a manner similar to that shown by *Opisthorchis*.

In experimentally infected cats, eggs were never found in the faeces less than 28 days after the meal of infected fish.

The fluke is able to live for at least five years in the cat, as one animal, fed infected suckers on the sixth of October, 1938, is still passing viable eggs in its droppings (in November, 1943).

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